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Before the
Office of the Secretary
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Guidelines for Evaluating the Environmental Effects of Radifrequency Radiation	)))	ET Docket No. 93-62

REPLY COMMENTS OF THE NARDA MICROWAVE CORPORATION

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I. EXECUTIVE SUMMARY

The Narda Microwave Corporation (Narda) supports the Commission's proposal to revise its radio frequency radiation (RFR) policy to use the IEEE C95.1-1991/ANSI C95.1-1992 human exposure standard as the basis for determining compliance. The Commission should review when measurements will be required to ensure compliance. Certainly, there are many instances where calculations or tables, such as an updated version of Bulletin OST-65 may be used to ensure compliance in lieu of measurements. However, insuring compliance and personnel safety must take precedence above all other issues. Note that no calculations or tables can be used to predict contact currents nor can contact currents be related to electric field measurements. Calculations are also of no value in transmitter rooms or in areas near transmission lines.

Narda supports the position of the Occupational Safety and Health Administration (OSHA) in reference to its interpretation of the distinction between "controlled" and "uncontrolled" environments. These terms have legal precedent in other areas of environmental health. **An RFR Safety Program must be in place to operate at levels above the uncontrolled maximum permissible exposure (MPE) guidelines. Under no conditions should the controlled MPE's be exceeded.**

Narda has developed a variety of unique products to specifically address the needs of broadcasters in complying with the new IEEE/ANSI Standard. These products include:

- o Shaped RMS electric and magnetic field probes that provide a unique measurement solution in complex, multi-signal environments.

- o Personal monitors with a shaped frequency response provide a simple, cost-effective way to dramatically reduce the chance of accidental exposure to RFR levels above the new Standard.

- o An accurate induced current meter that operates in high field levels at frequencies from 3 KHz to 110 MHz. This meter can also be used to measure contact currents from 30 MHz to 110 MHz.

- o A human equivalent antenna that closely replicates an average adult for induced currents eliminates broad measurement variations due to differences in body size and position and footwear, while reducing exposure and limiting liability.

- A unique contact current meter measures from 3 kHz to 30 MHz.

- Area monitors function automatically near transmitters to provide warning in the event that hardware fails and levels increase suddenly.

Protective suits must be viewed and used with extreme caution. Improperly used, exposure can be increased instead of reduced. Most suits do not block the magnetic field leading to questions as to how compliance with the new standard, which limits both electric and magnetic fields, will be interpreted. Reports of arcing between the face plate and the face of wearers and the effect of perspiration must be investigated.

II. NARDA SUPPORTS THE COMMISSION'S PROPOSAL TO EMPLOY THE 1991 ANSI/IEEE STANDARD IN ITS OWN REGULATORY PROGRAM

The Narda Microwave Corporation (NARDA) recommends that the Commission adopt the new IEEE C95.1-1991/ANSI C95.1-1992 Human Exposure standard to replace ANSI C95.1-1982. It is by far the most current, up to date standard available. It is based on a thorough review of the available research reviewed by a broad panel of representatives of government, industry and the research community.

The U.S. Department of Defense is awaiting final signature of its new standard which is almost identical to the new IEEE/ANSI Standard. It makes little sense for the various U.S. government organizations to have substantially different standards. The Commission's decision will be an important precedent for other, non-military government agencies. It is important for the country as a whole to have a common standard. If the Commission joins with the DOD in adopting the new IEEE/ANSI Standard, it is likely that most of the other Federal agencies will follow suit. In turn, state and local governments will have a concrete point of reference.

The alternatives are to:
(1) Retain the older, 1982 ANSI Standard.
(2) Adopt some other standard, such as ACGIH, IRPA, or NCRP.
(3) Make a hybrid standard based on two or more of the existing standards.

The alternatives are all older standards and are based on less up-to-date information. Adopting a hybrid combination of the standards (1) implies that the Commission is a health expert and (2) introduces additional confusion.

III. THE DEFINITION AND INTERPRETATION OF WHAT CONSTITUTES A "CONTROLLED" ENVIRONMENT WILL BE CRITICAL TO THE IMPLEMENTATION OF THE NEW STANDARD IN THE BROADCAST INDUSTRY. NARDA SUPPORTS THE POSITION OF THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) THAT A RFR SAFETY PLAN MUST BE IN PLACE TO OPERATE ABOVE UNCONTROLLED LEVELS (AND BELOW CONTROLLED) LEVELS.

Narda supports the position of the Occupational Safety and Health Administration (OSHA) in reference to its interpretation of the distinction between "controlled" and uncontrolled" environments. These terms have legal precedent in other areas of environmental health. **An RFR Safety Program must be in place to operate at levels above the uncontrolled maximum permissible exposure (MPE) guidelines. Under no conditions should the controlled MPE's be exceeded.**

The concept of "transient passage" used in the IEEE/ANSI standard to define an uncontrolled environment and a thirty minute averaging period do not make sense. How can the length of exposure be ***determined, limited*** or ***controlled*** in an ***uncontrolled environment***.

Historically, broadcasters have been most concerned about RFR issues largely when it involved the public's concern and potential limitations on operations. Such concerns over the public limiting citing choices, antenna design, and operational ERP are real business concerns even though the public's concerns are rarely based on levels close to approaching ANSI C95.1-1982 guidelines.

Broadcasters should be focusing on ***occupational exposure***. This means they should put an effective RFR safety program in place. Such action would:

- Make commission compliance and license renewal easy.

- Protect broadcast personnel

- Make it easier for the broadcaster to demonstrate the public's safety is being assured.

A two tier system should also make it easier for the public to accept a broadcaster's RFR safety plan as being a serious, effective safety program.

IV. A RATIONAL POLICY MUST BE ESTABLISHED THAT GOVERNS WHEN MEASUREMENTS WILL BE REQUIRED

(A) ELECTRIC AND MAGNETIC FIELD GENERALLY DO NOT NEED TO BE MEASURED PROVIDING CALCULATIONS AND TABLE D FROM AN UPDATED VERSION OF OST-65 INDICATE THAT THE LEVELS ARE BELOW "UNCONTROLLED" LIMITS

Calculations performed by professional engineers and/or based on an updated version of OST-65 that indicate, with confidence, electric and magnetic field levels below the ***uncontrolled*** MPE's in the IEEE/ANSI Standard need not be measured. Measurements should be required whenever and wherever these methods cannot ***clearly and confidently*** insure that the levels will always be below the uncontrolled MPE's.

Broadcasters often ignore the potential for overexposure in the transmitter room where calculations are not practical. Calculations are also of little value on a tower.

(B) INDUCED CURRENTS GENERALLY DO NOT NEED TO BE MEASURED PROVIDING THAT THE ELECTRIC FIELD IS SUFFICIENTLY BELOW THE LIMITS OF THE NEW STANDARD.

Narda supports the approach offered by the National Association of Broadcasters (NAB)[1]. In essence, when the electric field is well below its MPE, then compliance with the induced current MPE can be assured without direct measurement. When the electric field is above these levels (Appendix E, Figures 2 - 5 of Reference No. 1), then the induced current level must be measured to ensure compliance.

It is recommended that the Commission consider extending the IEEE/ANSI limits for induced and contact currents up to 110 MHz so that the entire FM band is handled in the same way. This will be especially helpful at multi-user sites.

The equipment needed to make these measurements is available for short term rental.

1 Evaluating compliance with FCC - Specific Guidelines for Human Exposure to Radio frequency Radiation, prepared for the National Association of Broadcasters by Jules Cohen, Appendix E.

(C) CONTACT CURRENTS ARE TOTALLY UNPREDICTABLE, BEAR NO RELATIONSHIP TO ELECTRIC FIELD LEVELS, AND CANNOT BE CALCULATED

This may be the most difficult area of the new standard for the Commission to deal with. On the one hand, when they occur, contact currents can be dangerous. Not only are there SAR and shock and burn issues, but also there exists the potential to react suddenly and dangerously to contact currents. This is especially true should this occur while an individual is in an elevated position such as on a tower.

Since contact currents bear no relationship to electric field level, the only way to quantify contact currents is to measure them. James Hatfield, P.E. of Hatfield & Dawson Consulting Engineers reports cases when extremely high contact currents were present in a 7 V/m field. However, it appears unnecessary for every broadcaster to make hundreds of contact current measurements where, in most cases, significant contact current levels will not be found.

A more rational approach may be to have the Commission require that contact current measurements must be made:

> On metallic objects, such as fences, that the public may come in contact with or that may be contacted by station personnel. These measurements should be made once to obtain certification and need be repeated only when antenna patterns are changed or whenever new metallic objects are added in the vicinity of the antenna(s).

The equipment to make these measurements could be made available for short-term rental.

V. NARDA HAS DEVELOPED A VARIETY OF UNIQUE PRODUCTS TO SPECIFICALLY ADDRESS THE NEEDS OF BROADCASTERS IN COMPLYING WITH IEEE C.95.1-1991

All of Narda's survey instruments and monitors use RMS detectors. They can be used with confidence to make accurate measurements with FM modulated, AM modulated, and pulse modulated signals and in complex multi-signal environments such as the typical broadcast "antenna farm." All survey instruments are extensively calibrated at both the band ends and throughout their rated frequency range at Narda's MIL-STD-45662 calibration facility. Accuracy is traceable to NIST within $\pm$ 0.5 dB.

A. SHAPED RMS PROBES PROVIDE A UNIQUE MEASUREMENT SOLUTION IN COMPLEX, MULTI-SIGNAL ENVIRONMENTS.

Narda's patented shaped probes are the perfect solution for measurements in multi-signal emitter environments. The sensitivity of these probes varies, at the point of detection, in accordance with major standards. The IEEE/ANSI models follow the controlled environmental limits of the new standard. One electric field model covers 300 kHz to 40 GHz, while the magnetic field model covers 300 kHz to 200 MHz. A new lower cost model, designed for broadcasters, will measure the electric field from 300 kHz to 2.7 GHz will be available in mid-1994.

These probes greatly simplify the task of determining compliance in multi-emitter environments because the field level from each emitter is automatically weighted in accordance with the standard. Figures 5-1 and 5-2 illustrate a simple three signal environment with an AM station, FM station, and a cellular base station. A normal, RMS flat probe will yield an accurate measurement of the total field strength. But since the relative contributions of the three signals can not be determined, compliance with the standard, where MPE limits are frequency dependent, is impossible to determine. The only other solutions are to drop the emitters off the air, turning one on at a time to measure field levels or, alternately, to make numerous narrow band measurements. Dropping the station off the air is highly undesirable. Narrow band measurement equipment is normally not very portable. More importantly, it is difficult for all but the most experienced users to accurately calibrate for field level measurements. In addition, the number of measurements that must be made is directly proportional to the number of emitters.

DETERMINING COMPLIANCE IN A MULTI-SIGNAL ENVIRONMENT

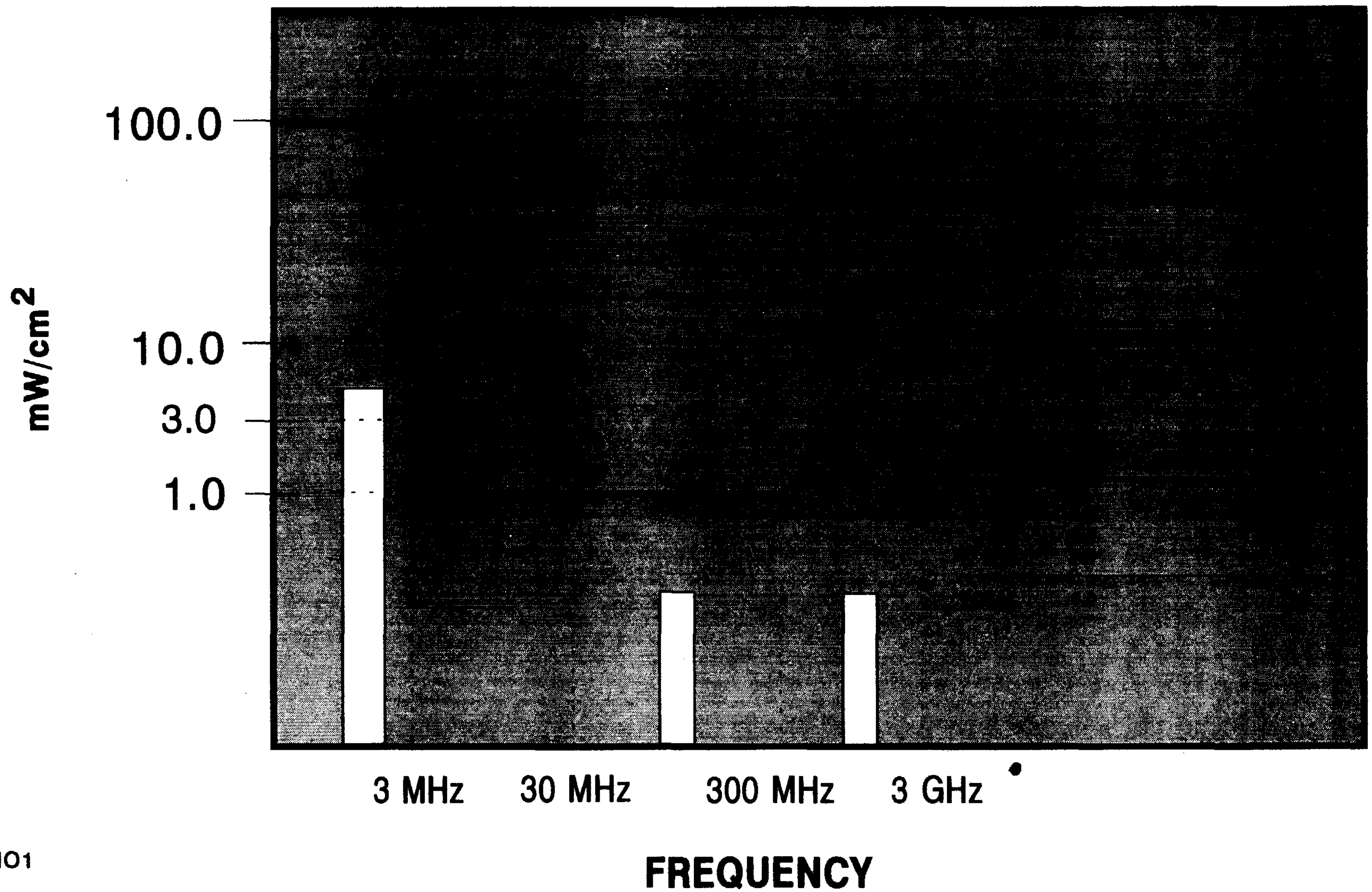

FIGURE 5-1

CASENO1

DETERMINING COMPLIANCE IN A MULTI-SIGNAL ENVIRONMENT

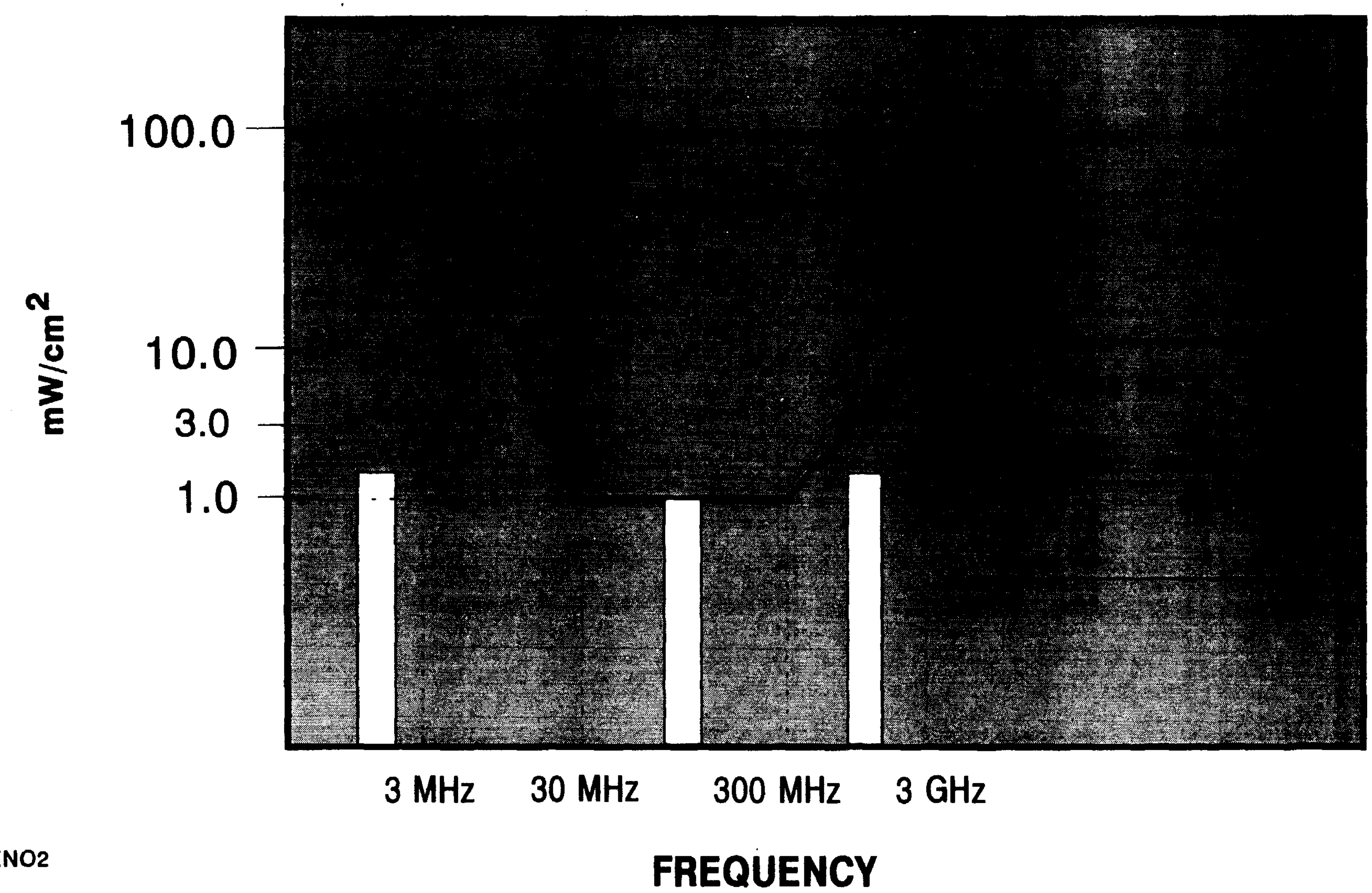

FIGURE 5-2

CASENO2

B. PERSONAL MONITORS WITH A SHAPED FREQUENCY RESPONSE PROVIDE A SIMPLE WAY TO REDUCE THE CHANCE OF ACCIDENTAL EXPOSURE TO LEVELS OF RADIO FREQUENCY RADIATION ABOVE THE NEW STANDARD.

Narda offers eight different models of RFR personal monitors. They vary by the frequency coverage, alarm threshold, and detection method. The four microwave models detect the electric field and have flat frequency response. They have been found to be very useful in the areas around satellite uplinks and SNG/ENG vehicles.

Two of the models specifically address the needs of the broadcaster. Both feature shaped frequency response in accordance with the new IEEE/ANSI controlled environment MPE's. Both detect the magnetic field. One model is rated from 50-1000 MHz. The other model is rated from 50-2500 MHz. The second model may soon be improved to cover up to 2700 MHz to cover sites that include wireless cable transmitters.

The alarm threshold on all models is fixed and purposely not user adjustable. The detection pattern is essentially a hemisphere. Assuming that the monitor is worn on the chest or belt on the front of a person, the area of reception will be the entire area in front, above and to the sides of the user. The alarm threshold is set to 50% of IEEE C95.1-1991 controlled environment limits. All frequency error, or deviation, from the ideal shape of the standard, is compensated for by setting the threshold at the point where the monitor is least sensitive relative to the standard. The 3 dB points, or half power beamwidth of the detectors, is 90° left, 90° right, 90° up and 65° down. Therefore, under the worse case condition of a signal directly overhead and at the least sensitive point in the band, the monitor will alarm ***at the threshold***. Conversely, at the most sensitive part of the band with the emitter in front of the wearer, the alarm will sound ***up to 6 dB below the threshold.*** The monitors respond to all politizations equally. The ellipse ratio is only $\pm$ 0.75 dB up to 700 MHz.

Some individuals have expressed concern that the monitors only detect one field where the standard requires measurement of both electric and magnetic fields below 300 MHz. The intent of the standard is to limit exposure to both electric and magnetic fields. Since the fields have a defined relationship in the far field, only one field need be measured. At the cut-off point of 300 MHz virtually all measurements made at a distance of 20 cm (the minimum measurement distance in the standard) from the emitters are in the far field.

The purpose of Narda's personal monitors is not to precisely measure field levels, but to warn a user that he or she may be in a field near the limits of the standard. Three factors make the use of single field detection personal monitors practical and dependable at the frequencies below 300 MHz:

1. The monitors alarm in less than one second. Fields on a tower, especially a multi-user site, are both time and spatially variant. A change of position of only a few inches can result in a significant change in intensity and, in some cases, whether the field is primarily magnetic or electric. Therefore, if an individual is not totally motionless, he or she will invariably transition through several areas where some will be more electric and some will be more magnetic. This transition will normally occur in a matter of seconds, far below the six minute period used to calculate average exposure. If the wearer is to remain motionless for an extended period of several minutes, the monitor can easily be removed from the body and swept at arm's length all around the user. The same logic of spatial field diversity applies.

2. Wearing the monitor on the chest or belt centers it between the two most sensitive parts of the body where spatial or whole body averaging is not allowed - the eyes and the male testes. Exposure of the extremities to higher field levels is far less of a hazard because of whole body averaging.

3. Under most conditions the wearer will be either in the far field or in a magnetic field. As Tell reported[2] the far field from simple linear antennas normally begins at a distance of $\lambda/2\pi$. Therefore, at 100 MHz, for example, the distance is only 19 inches. Even at channel 2, it is less than three feet. Practically, one can never get this close to an operational FM or television antenna and remain below the IEEE standard. This paper also shows that the majority of the energy near the antenna is in the magnetic field. The magnetic field on a tower is generally a better indicator of field strength at these frequencies because the electric field is altered by the presence of conductive objects including the human body.

[2] Richard A. Tell, EPA Publication ORP/EAD 78-4, Near-Field Radiation Properties of Simple Linear Antennas with Applications to Radifrequency Hazards and Broadcasting, 1978.

C. AN ACCURATE INDUCED CURRENT METER THAT OPERATES IN HIGH FIELD LEVELS IS AVAILABLE.

Narda's model 8850 Induced Current Meter accurate measures induced currents from 3 kHz to 100 MHz and is usable up to 110 MHz. The dynamic range is from 1 ma - 0.5% of the controlled environment standards to 1000 ma - 500% of the controlled environment limits. It also feature a shaped response "Percent of Standard" range that measures up to 200% of the controlled environment limits using the same technique of varying sensitivity as a function of frequency used in the electric and magnetic field probes.

This instrument was tested at the U.S. Navy's Surface Warfare Center in Dahlgren, Virginia. The results were entirely consistent with expectations. The size of the individual and footware differences yielded predictable results (see Figures 5-3 and 5-4).

This instrument is available to broadcasters for short term rental.

D. A HUMAN EQUIVALENT ANTENNA THAT CLOSELY REPLICATES AN ADULT ELIMINATES BROAD MEASUREMENT VARIATIONS THAT ARE DUE TO DIFFERENCES IN POSITION, BODY SIZE AND FOOTWEAR WHILE REDUCING EXPOSURE LEVELS AND LIMITING LIABILITY.

The Model 8858 Human Equivalent Antenna closely simulates an average human being from 50 Hz to 110 MHz. It is designed to be used with the Model 8850 Induced Current Meter (or any other functional, accurate induced current meter). The Model 8858 makes induced current measurements both safe and repeatable. In use, Model 8858 takes the place of a human subject when placed on the 8850 or the 8854B. Consequently, a measurement can be made without subjecting anyone to potentially hazardous currents. This is especially important since the new IEEE/ANSI standard limits exposure to one second. An individual can not make a measurement in a field in less than a large fraction of a second. Thus, making measurements with a human introduces both a potential hazard opens some liability issues.

Equally important, the results are very repeatable. The amount of induced current varies considerably with the size and physique of the person. The current levels also vary with the position of body parts. Raising one's arm, for example, induces more current into the body. Footwear introduces another significant variable. It may be

TEST 1

NARDA INDUCED CURRENT METER WITH HUMAN EQUIVALENT ANTENNA

FREQUENCY 24.450 MHz LOCATION NSWC Dahlgren

			INDUCED CURRENT (mA)				DISPLACEMENT CURRENT		E FIELD AT TEST POINT		
NARDA & HEA		PERSON	NARDA 8850	Holaday HI-3701	PROTOTYPE DH		NARDA 8850	Holaday HI-3701	HEIGHT (ft)	NARDA (mW/cm²)	EFS-1 (mW/cm²)
200	1	# 2	90	700	138		5	090 on 300K 600 on 1000K	1.5	.50	.60
	2	# 6	175	760	230				3.0	.75	.58
	3	# 8	78	630	142				4.5	1.0	.64
	4	# 5	108	700	180				6.0	1.5	.70

FREQUENCY 24.450 MHz LOCATION

			INDUCED CURRENT (mA)				DISPLACEMENT CURRENT		E FIELD AT TEST POINT		
NARDA & HEA		with Shoes Removed PERSON	NARDA 8850	Holaday HI-3701	PROTOTYPE DH		NARDA 8850	Holaday HI-3701	HEIGHT (ft)	NARDA (mW/cm²)	EFS-1 (mW/cm²)
	1	# 2	250						1.5		
	2	# 6	345						3.0		
	3	# 8	311						4.5		
	4	# 5	319						6.0		

FIGURE 5-3

Table 2 Test Person Characteristics

Person-Number	Height	Weight	Footware
1.	6' 0"	210	Dress shoes, rubber soles
2.	5' 6"	135	Casual shoes, rubber soles
3.	5' 8"	185	workshoes, rubber soles
4.	6' 1"	230	cowboy boots, rubber soles
5.	6' 1"	185	workshoes, rubber soles
6.	6' 1"	245	Dress shoes, leather soles
7.	6' 1"	230	Dress shoes, leather soles
8.	6' 0"	205	Casual shoes, rubber soles
9.	6' 0"	225	Dress shoes, leather soles
10.	5' 8"	225	Casual shoes, rubber soles
11.	6' 1"	210	Boat shoes, rubber soles
12.	6' 1"	185	Dress shoes, rubber soles

FIGURE 5-4

possible to establish an RFR safety program that specifies the minimum insulation properties of footwear to be used in high field areas. In the absence of such a program, one must assume the worst case. Wet, leather shoes are virtually the same as bare foot conditions. Narda's experience with measurements made on the US Navy's ground plane at the Surface Warfare Center in Dalgren, Virginia indicate that rubber sole shoes reduce induced current levels by up to 65% (See Figures 5-3 and 5-4)[3].

E. A UNIQUE CONTACT CURRENT METER IS AVAILABLE TO MAKE MEASUREMENTS UP TO 30 MHz. THIS DESIGN COULD BE ENHANCED TO PROVIDE OPERATION UP TO 110 MHz.

The Model 8870 Contact Current Meter displays the amount of current induced into the body by contact with a "hot" metallic surface that is in the vicinity of a high level, low frequency emitter. The amount of current induced into the body is displayed on a large-character LCD. The 8870 features an insulated "gun" to contact the surface which eliminates the shock and burn hazard. The solid, stainless steel base and the unique internal circuits form the equivalent of a barefoot human with grasping contact. This is the worst case condition. The 8870 operates from 3 kHz to 30 MHz and measures currents up to 1000 ma. Since the new IEEE standard varies the allowable induced current as a function of frequency, the "Percent of Standard" measurement feature simplifies operation. In this mode, shaping circuitry is used to make the 8870's sensitivity match the standard's controlled environment MPE limits.

[3] Note that the value for the Human Equivalent Antenna ("HEA") was only about two thirds of what it should have been. It was later determined that the contacts in the prototype antenna had been damaged and only the bottom two thirds of the antenna were in operation. Production units have eliminated this problem and the accuracy of the antenna has been independently verified by Dr. Om Ghandi.

F. AREA MONITORS PROVIDE CONTINUOUS PROTECTION AGAINST ACUTE EQUIPMENT FAILURE IN A TRANSMITTER ROOM.

Narda's SMARTS family of area monitors provides continuous detection of RF radiation within a specific area. Models are available to cover any frequency between 2 MHz and 44 GHz. These monitors represent a major advance in safety monitoring programs for non-ionizing radiation. In the past, a safety program was limited to performing periodic surveys of a particular system or area, which meant an acute failure could go undetected until the next survey was performed. The new standard limits exposure to an average over any six minute period. The use of survey instruments alone means a hazardous condition could go undetected for days, weeks, or even months. One broadcaster reports that a monitor found a potential hazard that was never even considered. The monitor had been purchased to calm employees' fears. Yet, it detected a failure in the finger contacts on the door of an amplifier cabinet. Microwave SMARTS were developed in response to the frequent, acute failure of flexible waveguide used in transportable military transmitter shelters. Can SNG/ENG trucks be much different?

Four models cover wide frequency bands from 2 MHz to 44 GHz. Model 8810 covers the 2 to 30 MHz HF band, Model 8815 operates from 10 to 500 MHz, and Model 8820 monitors frequencies between 500 MHz and 18 GHz. The ultra broadband Model 8825 covers 500 MHz to 44 GHz.

Each model features a unique design for accurate detection in a specific environment. At low frequencies, such as those around HF antennas and metallic shelters, the electric field component is typically greatly distorted. Therefore, the Model 8810 (2 to 30 MHz) monitors the magnetic field which is more consistent in these environments. Its alarm threshold is shaped to provide a frequency dependant threshold. It is set to approximately ten percent of the IEEE controlled environment levels so that a reasonable area can be monitored.

The model 8815 (10 to 500 MHz) utilizes what has been termed "transitional" monitoring. At frequencies below approximately 200 MHz, it responds to the magnetic field component and it transitions to electric field detection at frequencies above 200 MHz.

Model 8820 (500 MHz to 18 GHz) and Model 8825 (500 MHz to 44 GHz) use broadband thermocouple detectors to monitor the electric field. They are ideal for ENG/SNG applications.

VI. PROTECTIVE SUITS MUST BE VIEWED WITH EXTREME CAUTION

RFR protective suits are an attractive potential solution that might allow personnel to work in high field levels. If such a suit could be designed and manufactured, it would provide a good solution.

However, there are several areas of concern:

(1) There is no qualified independent organization that can competently fully test such products. This type of testing requires unique and complex testing that few, if any single individual, is knowledgeable enough to organize and conduct. Therefore, to do it correctly will require peer review of any such test results.

(2) Even a perfect protective suit requires proper use. The Swiss PTT have been using RF protective suits for several years. They treat their usage much like suits for ionizing radiation. They require a trained health and safety professional to be present and supervise the use of these suits. Their suits are very heavy due to the use of magnetic materials in their construction.

Even a ***perfect*** suit can be misused and lead to a false sense of security which could be highly dangerous. It is Narda's opinion that the vast majority of broadcasters have a very limited knowledge of radio frequency radiation and its effects on "protective" suits.

(3) Any safety product should not introduce or increase other hazards. For example, the protective suits currently available decrease visibility, especially peripheral vision. Additionally, traction or footing can also be degraded. Degrading either visibility or footing can increase the probability of a life-threatening fall.

The protective suits offered by Maxwell Safety Products (Maxwell) have been cited by Jules Cohen, P.E. and included, as an attachment, with the comments filed by the National Association of Broadcasters (NAB). This report states "one recently introduced material......has been tested extensively and endorsed by the Occupational Safety and Health Administration (OSHA) as providing compliance with ANSI/IEEE. This material endorsed by OSHA......". However, OSHA's comments filed on March 11, 1994 state: "It is important to note, as stated in the OSHA letter referenced by NAB, that 'OSHA does not approve nor endorse products.' In addition, OSHA did not conduct testing of the RF protection suit referenced by NAB, but did review the results of the manufacturer's sponsored research."

The Maxwell suits appear to reduce SAR when used properly. However, these suits do not reduce magnetic field levels. The IEEE/ANSI standards human exposure to both electric and magnetic fields. How will the Commission interpret the use of these suits in meeting the new standards when the MPE's for magnetic field levels will be exceeded?

The distributor continues to promote these suits without the optional footwear even though the research funded by Maxwell indicates that **wearing their suits without the companion footwear results in higher Specific Absorption Rates than not** wearing any suits at all. The most recent example of this misrepresentation is shown in Figure 6-1.

Several users have reported arcing between the faceplate screen and their face. Maxwell's testing program does not appear to have considered this potential hazard. Similarly, what will happen to a wearer when he or she perspires heavily and both the suit and the wearer become wet?

Maxwell has also filed comments that indicate that "all resonances that were apparent in the empty suit disappear." The data supplied shows the electric field with a human subject is much lower than with an empty suit. Is this due to an interaction between the electric field and the body? A reduction of field level implies current flow through the body.

Use protective clothing for safety in RF fields

Complying with the new FCC regulations about RF hazards is made easy with protective clothing that shields the wearer from RF energy. Employer liability always has been an issue; now a standard must be met.

By Joseph A. Amato

FCC licensees offering two-way radio, paging and cellular services that were exempt from RF hazard regulations soon may have to comply with the new ANSI/IEEE C95.1-1992 Standard.

Compliance will be required if new rules are adopted according to an FCC *Notice of Proposed Rulemaking, Gen. Docket 93-62,* in the "Matter of Guidelines for Evaluating the Environmental Effects of Radio Frequency Radiation."

Until now, there has been little or no concern about the RF hazard at base station sites on towers and rooftops. Any apparent concern usually involved broadcasters. The FCC also used to specifically exclude cellular facilities from certifying compliance with RF environmental impact rules.

A broadcast station is now responsible for the safety of any person in the vicinity of its transmitter. Regulations oblige the station to ensure that no one is exposed to radiation levels exceeding the ANSI standard.

When broadcast stations share a site, they all must cooperate in the matter of RF safety. The required procedure has been to reduce (or to turn off) transmitter power output to as many antennas as necessary to eliminate the RF hazard where work is being performed. Unfortunately, this procedure may not be followed when it affects station revenue.

Communications transmitter owners may be reluctant to reduce power or shut down for the same reason as broadcasters.

A worker wears a radio frequency radiation (RFR) protective suit of Naptex fabric made with a yarn consisting of stainless-steel microfibers in a cotton-polyester base while making RFR measurements near antennas on a tower.

In addition, it may be difficult to obtain the cooperation of multiple licensees for a rooftop or tower full of paging antennas, two-way radio antennas and cellular antennas to cut power during maintenance work.

Beyond FCC rule compliance is the issue of Occupational Safety and Health Administration (OSHA) regulations and an employer's responsibility to protect workers from an RF hazard, no matter who owns the transmitters. A way is needed to continue uninterrupted telecommunications service and to protect individuals working on or near the site.

Try this on for size

RF protective clothing (RFPC) provides an answer. (See Photo 1 to the left.)

Some protective clothing has reached the market without gaining enough recognition and acceptance to be used widely because of various drawbacks.

Naptex material (developed by NSP, Nordendorf, Germany) meets the pertinent RFPC requirements. Among these requirements are the material's comfort, durability, maintainability, effectiveness and ability to withstand inordinately high RF fields.

Protective clothing should be just that: clothing. It should be as comfortable as possible and able to withstand the rigors of regular machine laundering. Tests on preliminary clothing materials showed that, although they were fairly comfortable, they did not hold up well after repeated washing and drying. Most samples lost an average of 3dB-6dB of attenuation after a

Amato is RF radiation safety consultant at Maxwell Safety Products, Smithtown, NY. The company offers the RF protective clothing described in this article.

FIGURE 6-1